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Guidebook for field trips in southwestern New Hampshire, southeastern Vermont, and north-central Massachusetts: New England Intercollegiate Geological Conference, 80th annual meeting, October 14, 15 and 16, 1988, Keene, New Hampshire

New England Intercollegiate Geological Conference (NEIGC)

Bothner, Wallace A.

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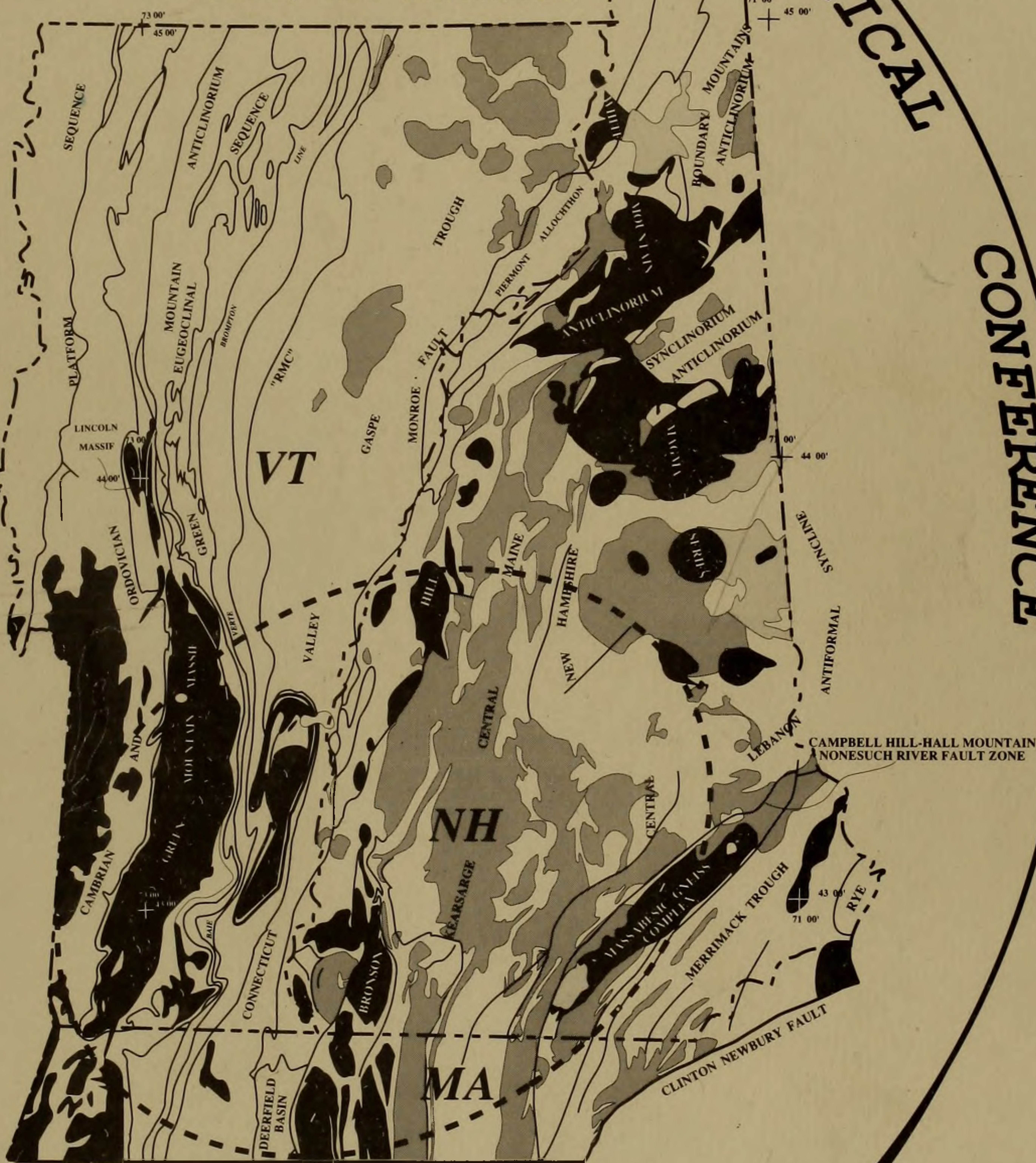
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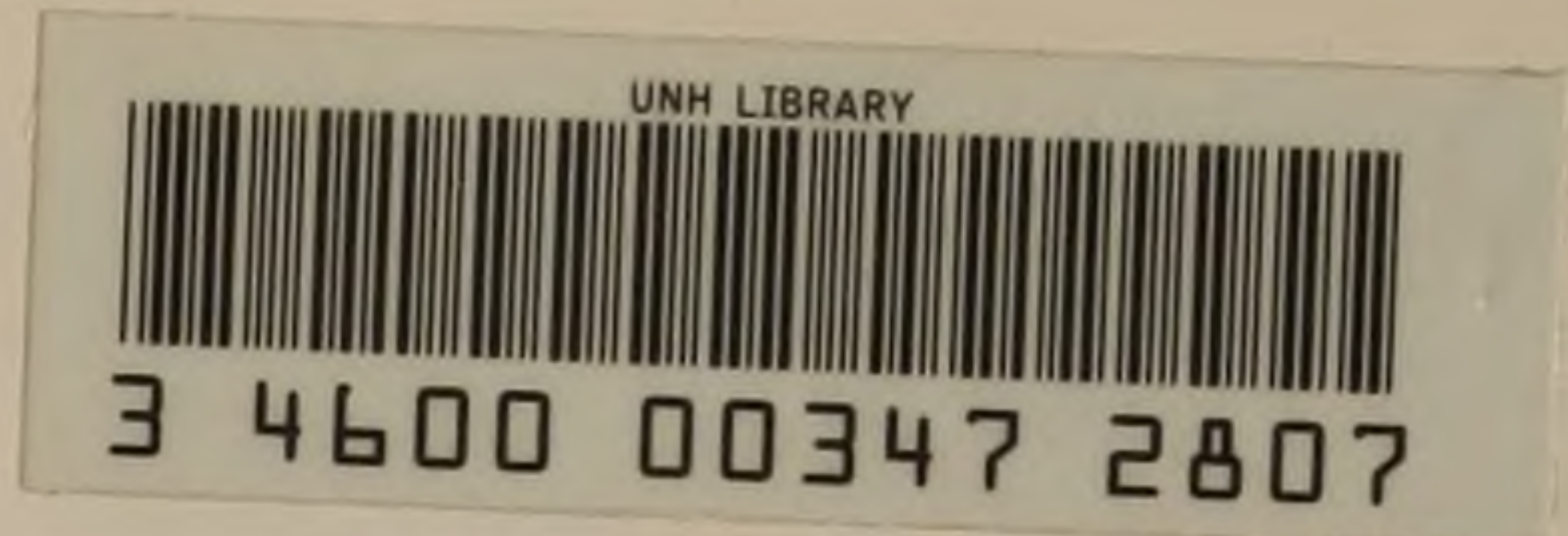
INTERCOLLEGIATE
1988
80th ANNUAL MEETING
OCTOBER 14 - 16, 1988
KEENE, NEW HAMPSHIRE

GEOLOGICAL
CONFERENCE

NEW
ENGLAND



USNH
University of New Hampshire
Keene State College



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Before visiting any of the sites described in the New England Intercollegiate Geological Conference guidebooks, you must obtain permission from the current landowners.

Landowners only granted permission to visit these sites to the organizers of the original trips for the designated dates of the conference. It is your responsibility to obtain permission for your visit. Be aware that this permission may not be granted.

Especially when using older guidebooks in this collection, note that locations may have changed drastically. Likewise, geological interpretations may differ from current understandings.

Please respect any trip stops designated as “no hammers”, “no collecting” or the like.

Consider possible hazards and use appropriate caution and safety equipment.

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THE HISTORY OF THE

CHAPTER

The first part of the book is devoted to the history of the country from the earliest times to the present day. It is a history of the people and of the land, and of the events which have shaped the nation.

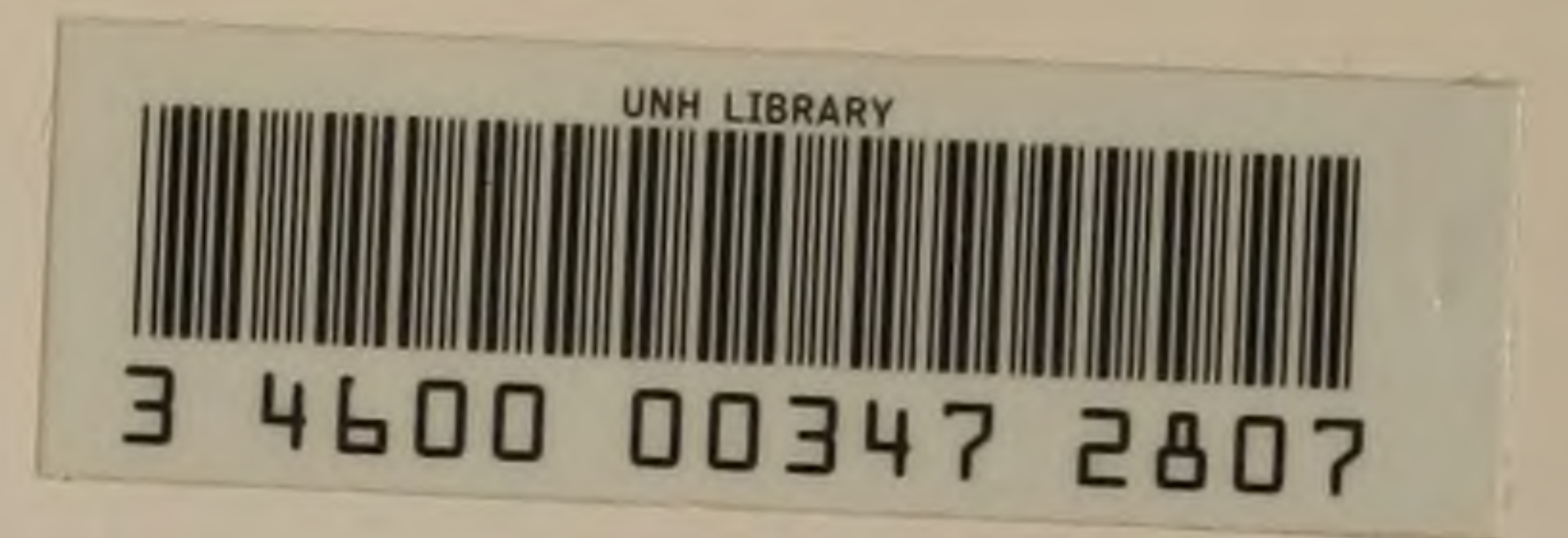
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NEW ENGLAND INTERCOLLEGIATE GEOLOGICAL CONFERENCE
80th Annual Meeting

**GUIDEBOOK FOR FIELD TRIPS
IN SOUTHWESTERN NEW HAMPSHIRE,
SOUTHEASTERN VERMONT, AND NORTH-
CENTRAL MASSACHUSETTS**

October 14, 15, and 16, 1988
Keene, New Hampshire

EDITOR

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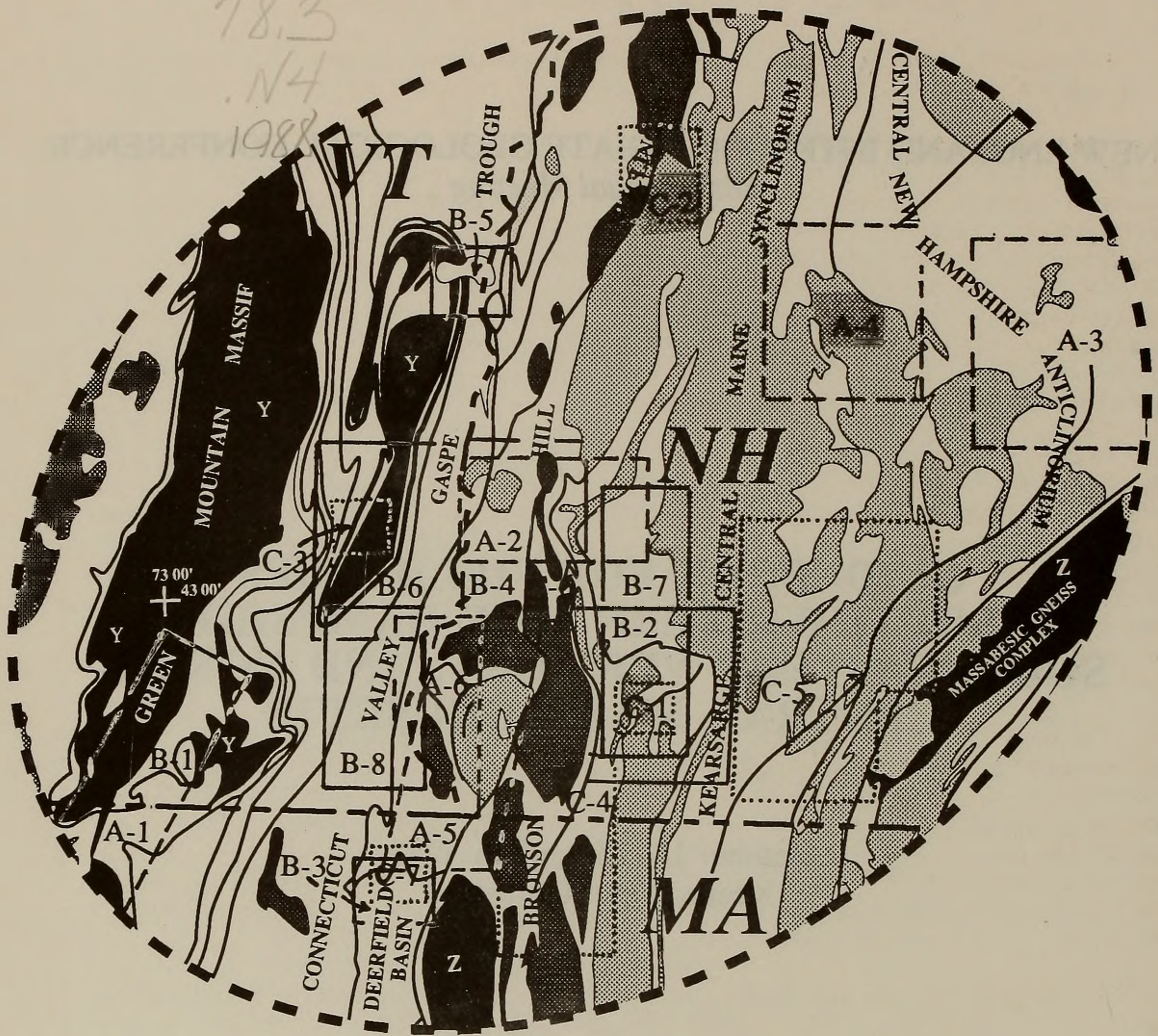


Figure 1. Location map is an enlargement of the cover showing the areas covered by field trips. Dashed line boundaries - Friday trips; solid line boundaries - Saturday trips; dotted line boundaries - Sunday trips

Copies of this guidebook are available at the address below as long as supplies last. The cost will be \$15.00 (including postage and handling).

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Cover: Geology generalized and digitized from Doll *et al.* (1961) and Stanley and Ratcliffe (1985) for Vermont; Lyons *et al.* (1986) for New Hampshire; and Zen (1983) for Massachusetts by J. Dykstra Eusden, Jr.

FOREWORD: NEW ENGLAND -- 80 YEARS OF NEIGC

"How shall we ever learn anything about orogeny, metamorphism, stratigraphy, paleoecology, or any other field of geology unless field investigations are encouraged?" M. P. Billings (1950, GSA Bull. 61, p. 445).

After more than eight decades of informal field collegiality among hundreds....thousands....of university faculty, other professionals, and students from scores of departments in the greater New England area, it is appropriate to recognize the very significant advances that have been made in our geologic understanding of an admittedly small geographic area. The northern Appalachian Mountains are laden with exciting geologic problems, pure and applied, that 'run the gamut' in our increasingly diversified science. Those problems have generated hosts of solutions: some "unexpected", some welcomed, and some (many?) controversial. Each has taken us at least a small step forward, and provided a springboard for continued efforts. NEIGC has played a major role in promoting informal, constructive, even sometimes "fiery", discussions *on the outcrop* that in the final analysis has opened minds, honed observations, and refined ideas. We have learned from one another and almost always come away with a greater understanding of, and appreciation for, the problems at hand.

This year also celebrates the 20th anniversary of the publication of the Billings' Volume (Zen *et al.*, 1968), noted eloquently in this guide by Karabinos and Laird. That volume quickly became, and continues to be, a poignant starting point for many ongoing studies in New England. Work summarized there spurred continued field studies that have resulted in major compilations including four new state geologic maps (Massachusetts, Zen, 1983; Connecticut, Rodgers, 1985; Maine, Osberg *et al.* 1985; New Hampshire, Lyons *et al.*, 1986) with both Rhode Island and Vermont maps underway, regional tectonic syntheses (Williams, 1978; Stanley and Ratcliffe, 1985; Lyons *et al.*, 1982; Hall and Robinson, 1982), and the DNAG publications (eg., Roy, 1987; Thompson *et al.*, 1986) covering both the on- and offshore regions of the Northern Appalachians. As they should, each begins and ends *in the field*.

Field trips for this year concentrate on the area in southwestern and central New Hampshire, southeastern Vermont, and north-central Massachusetts (figs. 1 and 2) which has not been visited by NEIGC for more than 20 years. The area records, in a highly compressed fashion, the effects of at least one billion years of earth history from Precambrian Y to the Quaternary. Ratcliffe *et al.* (Trips A-1 and B-1) and Karabinos and Laird (Trip C-3) emphasize the Grenville basement and its cover sequences, the effects of both the Taconic and Acadian orogenies, and the present best estimates for timing. Rosenfeld *et al.* (Trip B-6) provide new and exciting isotopic data from "snowball" garnets that indicate possible pre-Taconic growth as well as the rate of growth during Acadian polydeformation.

Stratigraphic, structural, metamorphic, and a bit of igneous geology are well represented in the Connecticut Valley trough (Hatch, 1987), the Bronson Hill anticlinorium, and the Central Maine Terrain (Zen, in press) and are attributed to Acadian activity. Hepburn (Trip B-8) updates work done in the Brattleboro quadrangle, Vermont, and discusses the important, and controversial, boundary between the "Vermont sequence" and the "New Hampshire sequence" while Schneiderman (Trip B-5) provides an opportunity to examine evidence preserved at Little Ascutney Mountain that the New Hampshire sequence overlay the Vermont sequence during Mesozoic White Mountain magmatic activity. The earlier and recently revived "probable late Ordovician age" for the Vermont sequence based on graptolites (Bothner and Finney, 1986), however, was discounted this summer when we re-examined the *outcrops*, and more lower Devonian plants were recovered from the Gile Mountain equivalent in Canada (Hueber *et al.*, in prep).

Acadian nappe formation, thrusting, and subsequent doming along the trace of the Bronson Hill anticlinorium is reviewed by those who originally identified them and, with their students, refined them. J. B. Thompson, Jr. (Trip C-3) reviews the Skitchewaug nappe in one of several areas where fossil control is "abundant" at high metamorphic grade. Chamberlain *et al.* (Trip A-2) carry the Skitchewaug nappe farther south and examine it and its nested neighbor, the Fall Mountain nappe. Robinson (Trip C-4) and his recent students, David Elbert (Trip A-5) and Peter Thompson (Trips B-2 and C-1) look at the evidence for early Acadian thrusting and the evolution of the Bernardston nappe from northern Massachusetts to the spectacular exposures on classic Mount Monadnock.

To the east Lyons (Trip A-4), Duke *et al.* (Trip C-5), and Eusden (Trip A-3) traverse the Central Maine Terrain in New Hampshire (Kearsarge-Central Maine synclinorium, Central New Hampshire anticlinorium, and Lebanon synformal anticline) and shed new light on the metamorphic and igneous geology of this important Acadian region. Recent recognition of the Rangeley (Maine) stratigraphy of Osberg *et al.* (1968) and Moench and Boudette

(1970) across central New England (Hatch *et al.*, 1984; Eusden *et al.*, 1986) has led to a clearer picture of the internal structure of the previously defined Merrimack synclinorium of Billings (1956). Detailed studies of Rumble and Chamberlain (Trip B-7) involving the role of fluids during metamorphism and magmatism revolve around historically important and no longer so enigmatic graphite deposits. The Acadian seems better understood as the Alleghenian emerges farther west (eg., Hepburn, and Eusden, this volume).

Well beyond academic interest, the increasing importance of Mesozoic and Cenozoic geology to "public needs" is reflected in the remaining five trips. A thorough analysis by Wise (Trip C-7) of brittle fracture phenomena in the Deerfield Basin as stress recorders has as important applications to present seismicity as it does to reconstruction of Mesozoic spreading. "Societal need to know" the distribution of surficial deposits, particularly the glacio-fluvial, has spurred renewed efforts to unravel the deglaciation history of New England. The Connecticut River valley (Larsen and Koteff, Trip A-6) and its tributary valleys (Washington and Larson, Trip B-3; Ridge, Trip B-4) preserve an unusually good record of deglaciation through the analysis of morphosequences and of the geomorphic development of this area (Caldwell, Trip C-6). Much of our future planning depends heavily on a continued commitment here and throughout the northeast.

It is clear that NEIGC serves as an important vehicle to respond to Billings' 1950 question. This informal, loosely-knit organization also raises an annual challenge -- to editor and to author -- to provide a platform for healthy debate, for learning, and for comradery. As our "permanent secretary" D. W. Caldwell noted (1970, p. ii): "Throughout its history the sole purpose of the NEIGC has been to bring together in the field those geologists interested and active in New England Geology, to consider and discuss the results of new mapping and other geologic studies." The tradition continues!

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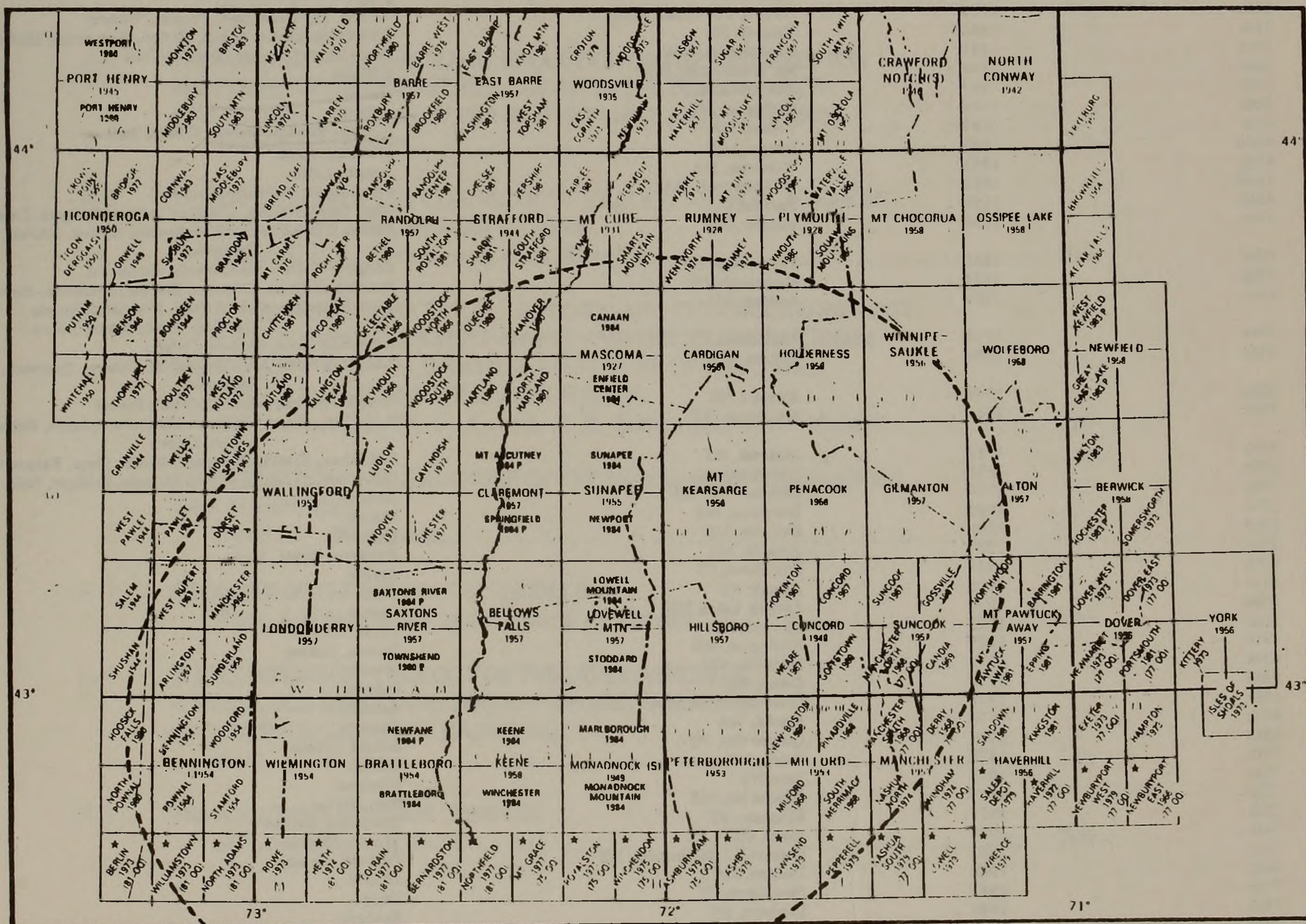
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ACKNOWLEDGEMENTS

I am very grateful for the willing and able assistance of Linda K. Hoadley and Natalie Simoneau in managing the "affairs of state" of NEIGC for 1988. Without that help, we would surely have been inundated, buried, and lithified.

Wallace A. Bothner, Editor
September, 1988

Figure 2. Topographic map index for southern New Hampshire, southern Vermont, and northern Massachusetts. After U.S. Geologic Survey Topographic Index (1986) for New Hampshire and Vermont.



CHRONOLOGICAL LISTING OF MEETINGS OF THE
NEW ENGLAND INTERCOLLEGIATE GEOLOGICAL CONFERENCE

Meeting	Year	Location	Organizer
1st	1901	Westfield River Terrace, MA	Davis
2nd	1902	Mount Tom, MA	Emerson
3rd	1903	West Peak, Meriden, CT	Rice
4th	1904	Worcester, MA	Emerson
5th	1905	Boston Harbor and Nantasket, MA	Johnson, Crosby
6th	1906	Meriden to East Berlin, CT	Gregory
7th	1907	Providence, RI	Brown
8th	1908	Long Island, NY	Barrell
9th	1909	North Berkshire Mountains, MA	Crosby, Warren
10th	1910	Hanover, NH	Goldthwaite
11th	1911	Nahant and Medford, MA	Lane, Johnson
12th	1912	Higby-Lamentation Blocks	Rice
13th	1915	Waterbury to Winsted, CT	Barrell
14th	1916	Blue Hills, MA	Crosby, Warren
15th	1917	Gay Head and Martha's Vineyard	Woodworth, Wigglesworth
16th	1920	Lamentation and Hanging Hills	Rice, Foye
17th	1921	Atleboro, MA	Woodworth
18th	1922	Amherst, MA	Antevs
19th	1923	Beverly, MA	Lane
20th	1924	Providence, RI	Brown
21st	1925	Waterville, ME	Perkins
22nd	1926	New Haven, CT	Longwell
23rd	1927	Worcester, MA	Perry, Little, Gordon
24th	1928	Cambridge, MA	Billings, Bryan, Mather
25th	1929	Littleton, NH	Crosby
26th	1930	Amherst, MA	Loomis, Gordon
27th	1931	Montreal, PQ	O'Neill, Graham, Glark, Gill, Osborne, McGerrigle
28th	1932	Providence-Newport, RI	Brown
29th	1933	Williamstown, MA	Cleland, Perry, Knopf
30th	1934	Lewiston, ME	Fisher, Perkins
31st	1935	Boston, MA	Morris, Pearsall, Whitehead
32nd	1936	Littleton, NH	Billings, Hadley, Cleaves, Williams
33rd	1937	New York City-Duchess Co., NY	O'Connell, Kay, Fluhr, Hubert, Balk
34th	1938	Rutland, VT	Bain
35th	1939	Hartford, CT - Conn. Valley	Troxell, Flint, Longwell, Peoples, Wheeler
36th	1940	Hanover, NH	Goldthwaite, Denny, Shaub, Hadley, Bannerman, Stoiber
37th	1941	Northampton, MA	Balk, Jahns, Lochman, Shaub, Willard
38th	1946	Mt. Washington, NH	Billings
39th	1947	Providence, RI	Quinn
40th	1948	Burlington, VT	Doll
41st	1949	Boston, MA	Nichols, Billings, Shrock, Carrier, Stearns
42nd	1950	Bangor, ME	Trefethen, Raisz
43rd	1951	Worcester, MA	Lougee, Little
44th	1952	Williamstown, MA	Perry, Foote, McFadyen, Ramsdell
45th	1953	Hartford, CT	Flint, Gates, Peoples, Cushman, Aitken, Rodgers, Troxell
46th	1954	Hanover, NH	Elston, Washburn, Lyons, McKinstry, Stoiber, McNair, Thompson
47th	1955	Ticonderoga, NY	Rodgers, Walton, MacClintock, Bartolome
48th	1956	Portsmouth, NH	Novotny, Billings, Chapman, Bradley, Freedman, Stewart
49th	1957	Amherst, MA	Bain, Johannson, Rice, Stobbe, Woodland, Brophy, Kierstead, Webb, Shaub, Nelson
50th	1958	Middletown, CT	Rosenfeld, Eaton, Sanders, Porter,
51st	1959	Rutland, VT	Zen, Kay, Welby, Bain, Theokritoff, Osberg, Shumaker, Berry, Thompson
52nd	1960	Rumford, ME	Griscom, Milton, Wolfe, Caldwell, Peacor
53rd	1961	Montpelier, VT	Doll, Cady, White, Chidester, Matthews, Nichols, Baldwin, Stewart, Dennis
54th	1962	Montreal, PQ	Gill, Clark, Kranck, Stevenson, Stearn, Elson, Eakins, Gold
55th	1963	Providence, RI	Quinn, Mutch, Shafer, Agron, Chapple, Feiniger, Hall
56th	1964	Chestnut Hill, MA	Skehan
57th	1965	Brunswick, ME	Hussey
58th	1966	Katahdin, ME	Caldwell
59th	1967	Amherst, MA	Robinson, Drake, Foose
60th	1968	New Haven, CT	Orville
61st	1969	Albany, NY	Bird
62nd	1970	Rangely Lakes, ME	Boone
63rd	1971	Concord, NH	Lyons, Stewart
64th	1972	Burlington, ME	Doolan, Stanley
65th	1973	Frederick, NB	Grenier
66th	1974	Orono, ME	Osberg
67th	1975	Great Barrington, MA	Ratcliffe
68th	1976	Boston, MA	Cameron
69th	1977	Quebec City, PQ	Beland, LaSalle
70th	1978	Calais, ME	Ludman
71st	1979	Troy, NY	Friedman
72nd	1980	Presque Isle, ME	Roy, Naylor
73rd	1981	Kingston, RI	Boothroyd, Hermes
74th	1982	Storrs, CT	Joeston, Quarrier
75th	1983	Greenville - Millinocket, ME	Caldwell, Hanson
76th	1984	Danvers, MA	Hanson
77th	1985	New Haven, CT	Tracy
78th	1986	Lewiston, ME	Newberg
79th	1987	Montpelier, VT	Westerman
80th	1988	Keene, NH	Bothner

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